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Method to Democratic Peer Assessment in Participative Design Education for the Virtual Ecosystem

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By

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Introduction

Online education has become the new norm in the world. Educational institutions worldwide have taken to online delivery of their subject content. Remote teaching is relatively a new concept for teachers and takes time to adapt for those who are not adept with technology. The story is not so different with the student community that is accustomed to traditional forms of learning methods, vis a vis in a classroom or studio. With this shift in teaching and learning methods, arises the need to relook at a possible new age curriculum and teaching, learning and assessment methods specific to progressive and inclusive design pedagogy for an online platform.

Design is a domain learnt by practice. Design tutors facilitate learning rather than deliver content. They are not carriers of knowledge but practitioners of an art that involves an established creative process. Though the method is established, the learning is in the practice of it with valuable feedback given during and after each project. The method of feedback to design students with respect to a project is individual and specific rather than collective and generic. This leads to pointed challenges in online mentoring making it time consuming. The challenges are multifold and complex when it comes to skill-based modules involving hands on exploration like carpentry, metal work, pottery and ceramics to name a few.

The present-day students have experienced a more traditional form of teaching, from school to university, and are equally unprepared for a completely virtual learning experience. They are habituated to a method which involves monitoring by tutors and the opportunity for co-learning and co-creating with their peers. One of the hurdles in virtual learning methods is establishing a human connect, peer socializing and the joy of learning together. This new format requires students to be motivated to engage in self-directed learning which poses challenges for students with lack of focus and motivation, especially with reduced tutor contact hours. The future of

virtual learning experiences could be a future of well-formed minds with little emotional intelligence. Hence, it is imperative that the future curriculum addresses these concerns for a holistic educational experience.

Technology has been a part of pedagogy in the new millennium within limitations. The role of technology in design pedagogy is quickly transforming from being a tool to being a participant in the process. With such drastic changes in the ecosystem, an immediate look at the design of curriculum, methods of delivery, framework for learners and educators and a participative assessment format, by both learner and educator, needs to evolve with an emphasis on practice-based education and learning by doing. It is also crucial to look at online platforms conducive to design education. This paper initiates a discussion and formation of frameworks which can later pave way for a new norm in virtual teaching and learning systems in design.

Assessment is an essential part of the teaching and learning system. It has to be aligned with the learning objectives of each lesson or unit taught. Purpose of assessment has to be carefully considered in order to improve student learning and increase performance. Furthermore the assessment pattern in design education needs more qualitative patterns of assessment than quantitative. This research work is an attempt to understand the effectiveness of the existing methods of assessment, understanding design education and its evolving trends, understanding students of the present and the importance of assessment in academic quality. Understanding of the above parameters shall aid acquire fresh perspectives to assessment and evolve better tools and techniques for the future.

Good feedback is critical to creativity, learning and performance, yet rare. Formative feedbacks encourage critical thinking and self-reflection on one’s work, especially in creative and open-ended domains such as design. Creativity is as uncomplicated as kids learning to walk and run and every kid develops his/her own method of learning to be creative. Creativity is in every action and can be understood as one's expression to life and focuses on the process of forming original ideas through exploration and discovery making feedbacks personal and all the more difficult. Many people do not know how to actually provide effective feedback. There is an increasing demand for quality feedback and thus feedback givers – in learning and professional settings. This article discuss/contributes empirical evidence on the various formats and practices

of feedback, the nodes at which these feedbacks are provided in reflection to the various stages of design thinking. It further explores the relation between feedback and creative milestone, both milestones set by the mentor as part of the design brief and milestones set by the participant as part of their design process.

Related Work

Logan [1], in his research inquired whether effectiveness in learning was enhanced by peer and self-assessment. According to the author, a self-regulated learning atmosphere impacting student learning is created in learning environments where peer and self-assessment are practiced. Such learning environments allow learners to compare their work with predetermined standards, refine and improve on their work boosting students' confidence. Logans' study focused on investigating students' attitude and inclination on peer and self-assessment. His study reported that peer assessment aided students constructively and made them reflect on their work critically. Logans' research did neither focus nor discuss students' feedback and perception of the assessment mechanism that impacted their learning, though claimed learning gains from a student perspective.

Boud. D, Falchikov. N [2] investigated in their research the parity between grading by instructor and that of peers; focusing only on the aspect of quantitative self-assessment. The research further addresses a few questions after extensive studies comparing various contexts of higher education courses like: (i) compared to teachers grading, do students under or over grade their own work? (ii) do leaners with varied abilities reflect the same patterns? (iii) compared to teachers grading, do students in varied levels or kinds of course over or under grade their own work? (iv) does practice or time aide learners improve their ability to rate themselves? (v) do learners exhibit patterns of neutrality when for formal assessment purposes their self-assessed grades are taken? (vi) does gender play a role or reflect in self-rating? The research paper also highlights issues in method of earlier studies conducted and recommends methods to improve analysis and presentation of information collated.

Peer assessment was defined by Reinholz [3], as make judgments about the work of others based on a set of activities. Prior research though demonstrates that self-assessment is promoted through peer review, their relation is ill-defined. Reinholzs' model of assessment cycle, demonstrates how peer assessment supports self-assessment, and renders from theories of self-assessment to establish how peer assessment enhances learning experience. The self-assessment model as described in the literature is applied to three specific peer assessment activity structures involving marking or grading, analysis & feedback, conferencing & revision. Reinholzs method stand apart from earlier research where, learning opportunities are explored rather than focusing on calibration of peer and instructor/expert grades.

Bourke, R., & Mentis, M. [4] investigated a perspective different from the earlier studies to understand the benefits of inclusive learning on self- assessment. The author reported that learners "inclusion in choices about their learning" provided for adequate learning opportunities as did self-assessment impact students involvement in their learning process. This aligns with Topping [5] report that indicated that in self-assessment, the intention is to engage the leaners as active participants in their own learning. In the longer run, it would enable learners to manage their own learning through self-management and wait for others to intervene.

Kulkarni, C., & Klemmer, S.R. [6] described that the ability of a professional designer and design students to accurately assess the quality of one's work is a vital skill and should be alike. The paper illustrates students at a large university in the US, who can self-assess their work through efficiently design teaching material. These teaching material have efficiently aided students in self-evaluation where 69% of self-assessed scores matched that of their staffs in a weekly student submission. It was also noticed that self-assessment improved over the period of the term. Three main hypothesis were tracked and analyzed by data: (i) to assure that milestones hard to measure such as student feedback are met by the teaching material designed for the course, (ii) to examine problems early and to identify potential scope for improving teaching methods; and (iii) to aide staff identify and help learners that may need guidance. It was also recorded that feedback based on rubrics posed challenges to an international audiences unfamiliar with instructional language.

Kulkarni. C, et al [7] recorded their findings on peer and self-assessment from two iterations of the study conducted on the first large online classroom. In both iterations, both staff-assigned and peer grades highly correlated. 42.9% of students graded within 5% and 65.5% within 10% of the staff grade in the second iteration. Students graded their work 7% higher on average compared to that of their staffs. Peer submissions from their own country tended students to rate their work marginally higher than works of students from elsewhere. To improve grading accuracy, they performed three experiments, which reported that: (i) Grading inconsistency in students decreased when feedback on their accuracy was provided, (ii) short snippets to trigger students to ponder on common issues with assignments, improve quality of students feedback, (iii) rubrics with simpler words, parallel sentence structure and better defined dimensions aide peers in improving their skills of assessment. Most often it is difficult to independently assess "controversial" work with rubrics. The study also reflects that present day online platforms lacks sensory connect to human teachers. Furthermore the platforms only takes final submissions and does not showcase students process.

Kulkarni. C, Bernstein. M. S, and Klemmer. S. R, [8] in their research reported that the core element of mastery in learning practices is by providing rapid feedbacks to students. Such a practice is difficult in open-ended project-based online classes, as it is time consuming. The paper hypothesizes that a continuous presence of peers with their feedback promises for a dynamic and iterative learning process. This is in contrast to the model of online education available today which is based on learn-and submit. A student submits their draft, provides rubric-based feedback on two peers' drafts, and then receives peer feedback on theirs. This process can be repeated by the student as many times as they desire. In controlled MOOC environments, it took twenty minutes for an average student to receive feedback. It was reported that rapid feedback on in-progress work improves course outcomes and impacts final grades while feedback delayed by 24 hours rendered less impact. Future work could iterate on reducing reviewer burden by calibrating reviewer agreement and simplify rubric items.

Kahng. A, Kotturi. Y, Kulkarni. C, Kurokawa. D, Procaccia. A, [9], experimented using the method of pairwise rank aggregation, where pairwise comparisons based on an algorithm calculates the complete rankings while not affecting the qualitative nature of the assessment. Based on the contribution of players to a project or job, the method considered and collated the

opinions of the player over peers. These collated opinions of players are represented as rankings and the results are published as the social ordering of the players. To prevent strategic behavior, the researchers designed randomized algorithms that are impartial and closely emulate tank aggregation rules, where players cannot influence their own position in the output ranking. Field study results exhibits the efficiency and practicability of the algorithm. Future work could investigate the relevance and adaptation of pairwise rank aggregation in skill based design courses.

Cambre. J, Klemmer. S. R, and Kulkarni. C, [10] built their study on theories of learning through contrasting cases, and this research is the first systematic evaluation of comparative peer review. Experts gave higher rating to learners who compared submissions, and wrote longer reviews and self-reflections than learners who evaluated one submission at a time. Another review reiterated the correlation of staff ranking with peer ranking derived from learners' comparisons. Both the above studies demonstrates that learner reflect better and write better feedback on comparing algorithmically-curated pairs of submissions. These results do not establish learning gains or transfer quantitatively. The study suggests that researchers collaborate in course development early on with instructors to record the advantages of comparative feedback. Future work shall concentrate on how comparison can leverage self-assessment and investigate if pairing submissions based on more specific dimensions like content or quality yields better feedback.

Kotturi, Y., Kahng, A., Procaccia, A., & Kulkarni, C. [11] developed an interesting method to hire large number of people that leverages on methods of peer assessment, called HirePeer. The tool promises an honest assessment of fellow hirees' job application materials through peer assessment; the results of which are then aggregated using an impartial ranking algorithm. This paper records findings from three field experiments that examine how peer-assessed hiring contributes to costs and benefits to workers and employers. Firstly, the study reports algorithms must be structured with terms of impartial effects to provide for honest assessments. Secondly, to guarantee impartiality while impartial rank aggregation algorithms incur a small cost for accuracy, in practice peer assessments are highly accurate. Thirdly, workers find targeted feedback on their job material from peer-assessed hiring reports to be highly useful. The highly agreeable findings from the study on peer-assessed hiring methods offer an alternate, scalable method to hire experts in scale. The study also points to the grave situation when a coalition of

workers could collectively manipulate final placement by always selecting each other's proposals. Future work could investigate mechanisms resilient to collusion and incorporate concerns of anonymity.

Cook. A, Hammer. J, Elsayed-Ali. S, and Dow. S. [12] explored how scaffolding can affect feedback exchange so peers can engage in a more meaningful feedback process. Within a course, the instructors introduced methods for peers to write questions to receive constructive feedback from their peers. Four main types of guiding questions were written by student who wanted feedback focusing of improve, share, brainstorm and critique. It was found that more specific and actionable feedback was received with the "improve" questions than others, though receivers wrote them the least. The research offers an understanding of methods to facilitate peer feedback exchange by scaffolding the questions writing process. Future studies could seek to establish different phases of the feedback process can benefit from interactive learning methods. For example, what happens when peers respond to feedback they receive constructively in an interactive manner? A deeper understanding of all the possible phases when a peer would like to interact and seek feedback needs to be mapped when building an intellectual model for peer feedback.

Easterday M.W, Rees Lewis. D & Gerber E.M. [13], proposed a hybrid crowdsourcing system that combines the intelligence of a group of novices in physical setting to formulate an alternate approach to providing intelligent formative feedback. The study highlights that crowd-critique methods provide a plethora of features like: quick login and invite tools, social media like interface, leading hints for feedback, guiding question for questions, hash-tags, along with some tools to enable social practices of writing. This platform and its method was found to improve formative feedback for ill-defined problems. Such a system with reduce production blocking, grounding comments, scaffolding and recording critique creates a dual-channel conversation and contribute to effective and impactful peer critiques.

Alfaro. L & Shavlovsky. M, [14] in their study reflected that hard-to grade submissions rather than imprecise students contribute to large grading errors. It was detected that considering the quality of the students own work, their feedback performance weakly correlates with the accuracy in their review in relation to the student's proficiency. It was also recorded that the

correlation between accuracy of the review to the time taken to perform the review was not complimentary. Furthermore students who received critical reviews clearly responded with a feedback that reflected an attitude of tit-for-tat behavior.

Nicol. D. J, and Dick. M [15] in their research they connected the seven principles that are introduced as "good feedback practices" with the self-regulating learning theory, specifically developed by Winne [16]. Nicol and MacFarlane-Dick [15], were among the first authors to provide specific connections between the two fields of formative assessment self-regulated learning, combining assessment literature [17] [18] with studies coming from self-regulated learning scholars [19] [20]. The authors defined feedback as information on the students' present level of learning and performance compared to that of a milestone or standard set for the course. In this method, students generated their own internal feedback based on the progress made towards their goals after monitored their engagement with respect to their learning activities. Those students who had better self-regulation abilities, reflected better on their progress with actionable feedback to achieve their desired goals. Additionally, they referred to the seminal work of Sadler [21] and Black and William [22] to iterate three major conditions that would benefit students to provide constructive feedback: (i) understand milestones and the desired performance required to achieve them, (ii) understand their current ability and performance towards achieving the set milestone, and (iii) the effort required to bridge the gap between the two to achieve theme milestone in a set time period.

Carless. D & Boud. D.[23] building on previous definitions, the author defined feedback as a process through which learners understands and reflects on the information and feedback provided from various sources to use them for the enhancement of his own work by aligning his learning strategies. This definition emphasizes the role of students at the center of learning and using his own comments and sense-making to improve his subsequent work. This perspective in assessment goes beyond the idea that teachers are the principal agents informing students about their strengths, weaknesses, and that they are the soul guides who provide direction on how to improve ones' work. The authors then continue to define student feedback literacy as the students ability to understand and comprehend the sense of information provided and apply them to negotiate their learning strategies and enhance their work. The study discussed on how to develop the students' feedback literacy and composed four inter-related elements to achieve

them. First, to appreciate the value and process of feedback. Second, ability to judge the quality of their work and others. Third, feedback can trigger emotions that needs managing, and lastly the ability to respond to a feedback. However, the study does not explicitly illustrate the operationalization of these elements. To develop feedback literacy Carless and Boud provided a few examples of activities and tasks needed, though some parts remained generic in description. Activities suggested by them included analyzing exemplars, peer feedback, and describing teachers role in the development of student feedback literacy.

Hicks.C & Pandey.V, Fraser. C and Klemmer, S.R. [24] in their research conducted three experiments that illustrated how reviews can be impacted simply by how they are framed. A few features that contributed to significant difference in the quality and focus of reviewer feedback were: (i) changes in rubrics and assessment guides, (ii) structure of the task, and (iii) representation of final artifact. Three experiments were studied where features of the review environment were manipulated. The researchers added a numeric scale to open text reviews to enthuse peers to provide review, but the quality of reviews were found to be low. They shortened and chunked stages of the review task to enthuse reviewers to provide diverse feedback. They also showed reviewers a work in progress work along with finished work to sensitize reviewers to focus their reviews more on the works' goal than aesthetic details.

Grasso. A, and Roselli. T. [25] described a cooperative student method (Cooperative Student Assessment - CSA) which builds a system-student assessment method. Here the ability of the student's estimation of self-assessment of their activities is used along with system built algorithm. This prototype for children, in which CSA was implemented, was used in field experiments to assess the learning of fractions. When students are able to assess their abilities and aptitudes, they become active participants in the assessment process. This enables them to be more aware of their progress in particular areas of the domain and be able to define their future learning targets. On the contrary, the side effect of students' involvement in assessing their knowledge is they frequently have a lot of queries and becomes distracting and disturbing for teachers. This cloud of questions and doubts instills a sense of unease in children impacting negatively on their learning process.

Yousef and his co-researchers [26] investigated the significance and practice of peer assessment in blended MOOCs (bMOOCs). Blended MOOCs have two learning environments; a physical classroom that brings together face-to-face interactions, and other concentrates on online activities. This paper focuses on blended MOOCs classrooms where peer assessment is implemented. The findings from the study show that implementing a flexible rubric ensures quality in peer assessment and feedback process. Furthermore the study reiterated that, peer grading shall only be of final grade and executed online, while all forms of formative feedback shall happen in the classroom along with a teaching assistant as a guide to students. This method optimally uses the advantages of both the environments.

Patchan. M.M, Schunn. C.D, and Clark.R.J. [27] examined the consistency and accountability of peer gradings and the quality of peer feedback comparing three conditions; (i) accountability of only grading, (ii) accountability of only feedback, (iii) accountability of both grading and feedback. Students who believed their grading methods would be rated for efficiency, provided better feedback with guiding solutions, and localized comments. These students also thought their reviewing grade would influence student performance provided more consistent ratings than those who did not believe so. These findings indicate that a large influence on peer assessment and consistent ratings could be rooted in the quality and effectiveness of peer feedback and commenting. Future work could study how mental activity works to understand whether reviewers process the task of rating differently (intuitive feeling) from the task of commenting (analytical process), we would need more data from similar experiment.

Mandala, M., et al [28] investigated the impact on the quality of feedback generated and student perception of effort required by structuring peer reviews using a team of reviewers instead of individual reviewers. They study reflected that higher quality of is produced when a collaborative team of reviewers provide feedback than did individual reviewers. Students spent more time on collaborative reviews than during individual review sessions and found them to be intellectually more engaging and fun. As a feedback to the task, student response reflected that both the individual and team review tasks required the similar efforts though took longer to come to a team consensus. Insights from the study showed team review approach to help even novice reviewers to provide well rounded, holistic feedback in engineering design courses, and concluded that collaboration improved student engagement in the process.

Problem Statement

Several studies have been done on peer assessment in physical classrooms but very few methods of peer assessment has been developed and tested for large online classes. This research work is an attempt to understand the effectiveness of the existing methods of assessment for online classes, understanding design education and its evolving trends, understanding students of the present and the importance of peer and self-assessment in online classes to uphold academic quality. The research shall also discuss and contribute empirical evidence on the various formats and practices of feedback, the nodes at which these feedbacks are provided in reflection to the various stages of design thinking. It shall further explore the relation between feedback and creative milestone, both milestones set by the mentor as part of the design brief and milestones set by the participant as part of their design process.

Aim

To develop a tool and investigate its effectiveness in peer, self-assessment and feedback methods for design courses in large online classes.

Objective

1. To understand the effectiveness of existing peer assessment methods for online classes and understand their shortcomings.
2. To develop a tool for peer, self-assessment and feedback method for open-ended design courses in large online classes.
3. To conduct field experiments to evaluate the tool designed and developed.
4. To record the findings from the field experiments and reflect on the contribution and shortcoming of the tool.

Rationale

Technology has been a part of pedagogy in the new millennium within limitations. The role of technology in design pedagogy is quickly transforming from being a tool to being a participant in the process. With this shift in teaching and learning methods, arises the need to relook at a

possible new age curriculum and teaching, learning and assessment methods specific to progressive and inclusive design pedagogy for an online platform.

Motivation

The education technology ecosystem has seen drastic changes ,and an immediate look at the design of curriculum, methods of delivery, framework for learners and educators and a participative assessment format, by both learner and educator, needs to evolve with an emphasis on practice-based education and learning by doing. It is also crucial to look at online platforms conducive to design education.

Research Questions

1. Does Peer Assessment enhance critical thinking?
2. Is comparative review a better method for peer range grading?
3. Is it possible to explore alternate methods to traditional rubrics to improve peer understanding of desired outcomes?
4. Can peers provide constructive, personalized feedback in online classes?
5. Does three way comparative assessments provide for better accuracy in grading compared to two way comparative assessment?
6. How impactful is peer feedback through comparison of two or more submissions compared to that provided for a single submission?
7. Does peer feedback through comparison provide high quality feedback than peer feedback provided for a single submission at a time?
8. Do guiding rubric and adaptive sentence starters prompt for better qualitative peer feedback?
9. How does comparative peer review impact self-assessment and learners' understanding of their own work?

Hypothesis

H0 – Null Hypothesis

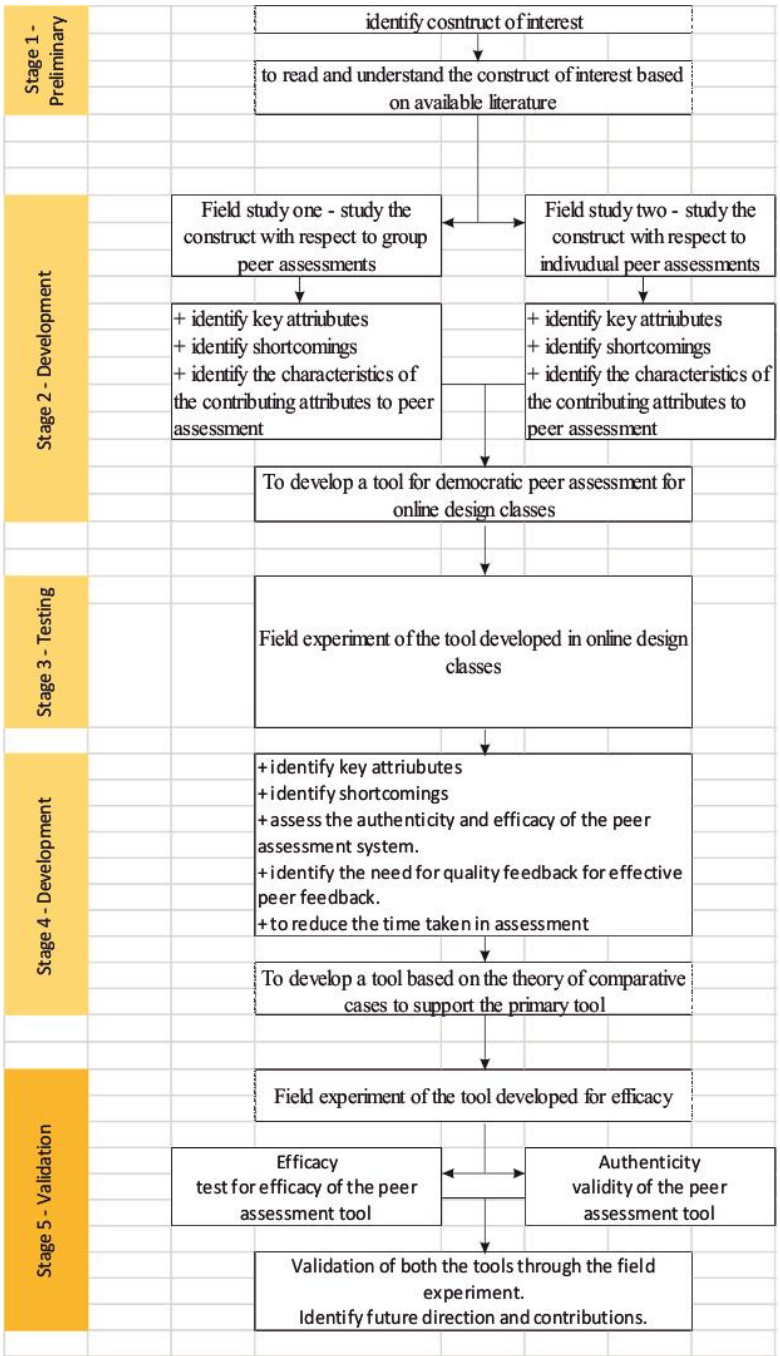
There is no significant difference in assessment results while using comparative peer review method for open-ended project based courses in large online classes.

H1 – Alternate Hypothesis

There is significant difference in assessment results while using comparative peer review method for open-ended project based courses in large online classes.

Research Methodology

The research shall be divided into 5 stages as shown below in the flow chart;


Stage 1 - Preliminary
identify cosntruct of interest
to read and understand the construct of interest based on available literature
Stage 2 - Development
Field study one - study the construct with respect to group peer assessments
Field study two - study the construct with respect to indivudual peer assessments
+ identify key attriubutes
+ identify shortcomings
+ identify the characteristics of the contributing attributes to peer assessment
+ identify key attriubutes
+ identify shortcomings
+ identify the characteristics of the contributing attributes to peer assessment
To develop a tool for democratic peer assessment for online design classes
Stage 3 - Testing
Field experiment of the tool developed in online design classes
Stage 4 - Development
+identify key attriubutes
+identify shortcomings
+assess the authenticity and efficacy of the peer assessment system.
+identify the need for quality feedback for effective peer feedback.
+to reduce the time taken in assessment
To develop a tool based on the theory of comparative cases to support the primary tool
Stage 5 - Validation
Field experiment of the tool developed for efficacy
Efficacy
test for efficacy of the peer assessment tool
Authenticity
validity of the peer assessment tool
Validation of both the tools through the field experiment.
Identify future direction and contributions.

Expected Outcomes

1. Gain insights into shortcomings of existing assessment tools.
2. Design a systemic architecture for an effective assessment tool for project based online classes
3. Gain insights into the efficacy of comparative peer review of the tool and accentuate its accountability
4. Establish efficiency of guiding questions as an alternate to standard rubric structure in peer grading and feedback.

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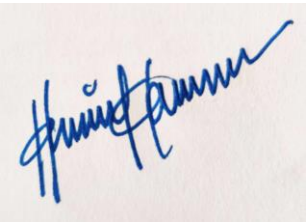

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